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Laboratories

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CXRO operates several laboratories for the manufacture and characterization of X-Ray optics. The most prominent involve fabrication of nanometer-sized structures in the nanofabrication laboratory, and the creation and characterization of multilayer optics in the multilayer laboratory.

Nanofabrication

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The term nanofabrication refers to a key set of underlying techniques with extremely broad application across many areas of science and technology. The nanofabrication program is designed to advance the state of the art to enable the patterning of materials at nanometer length scales. The primary research thrusts are in the areas of lithography and resist and etch process development.

The world-leading expertise developed in the nanofabrication laboratory is applied to many different projects, including:

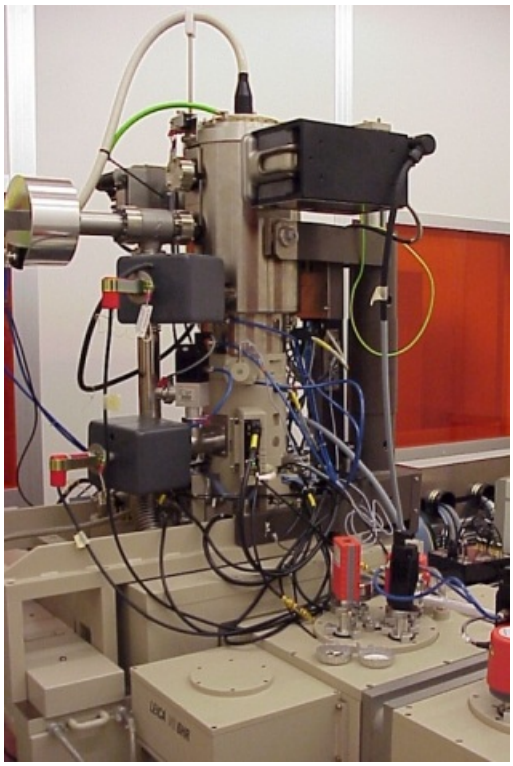
- Diffractive x-ray optics for microscopy and interferometry.
- Semiconductor lithography research.
- Nanomagnetism.

Selected Recent Publications:

1. *E.H. Anderson, "Specialized electron beam nanolithography for EUV and X-ray diffractive optics", IEEE J. Quant. Elect., 42, 27-35 (2006).*
2. *W. Chao, B.D. Harteneck, J.A. Liddle, E.H. Anderson and D.T. Attwood, "Soft X-ray microscopy at a spatial resolution better than 15 nm", Nature, 435, 1211-1213 (2005).*

Images From the Nanofabrication Laboratory:

A size comparison between a zone plate (the gold circle) and a human hair. This is a spiral zone plate, 86 microns in diameter, with 300 zones spaced 72 nanometers apart. More details are available at the diffractive optics page.



The Nanowriter, the centerpiece of the nanofabrication facilities. It enables the fabrication of significantly improved diffractive x-ray optics, structures for surface and materials science, quantum electronic devices, and using its unique stitching accuracy, complex mask structures for nanoelectronic lithography applications.

The atomic force microscope (afm) (left) and the scanning electron microscope (sem) (right) are used for characterizing features created using the nanowriter and other tools.

The contact aligner.

Electroplating is used to deposit thin films of conductive materials to tune the optical properties of elements produced in the lab.

The ICP/RIE Etching apparatus

Many processes in the nanofabrication laboratory depend on wet chemistry techniques.

For more information about the nanofabrication laboratory, please contact ehanderson [at] lbl [dot] gov">Erik Anderson.

Multilayer Coatings

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Manufacturing and characterization of single- and multi-layer coatings for short-wavelength optical applications.
